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Agriculture and science link through the "Living Soil"

Abstract: *This project tested a curriculum and team-teaching model to enhance secondary student awareness of how soil health, as enhanced by earthworm activity, plays an important role in sustainable agriculture. Evaluation revealed that team teaching was effective in conveying this material to students. A follow-up project will adapt the curriculum for science classes (grades 3 to 12) throughout Iowa.*

Background

During 1992-1994, in an earlier project funded by the Leopold Center and the Resource Enhancement and Protection Program (REAP), the principal investigator developed a curriculum to help Iowa's agriculture teachers instill environmental concern in their students. The project focused on the soil as Iowa's greatest natural resource. The impetus to develop this curriculum was based in part on a 1987 study of Iowa high school students that revealed no significant difference between high school freshmen and seniors in their attitudes toward soil conservation. The survey revealed a lack of awareness about such issues as the rate at which nature replaces topsoil, whether highly erodible land should be used for row cropping, whether soil erosion is within farmers' control, and whether row cropping in general is an effective conservation practice.

To increase awareness of soil's status as a resource, the project tapped into the network of Iowa's agriculture teachers and students. Designed to stimulate interest in tillage systems, chemical use, and their effects on the soil, the curriculum, called "The Living Soil," featured the earthworm as the principal performer and integrated this concept into hands-on laboratory and field activities.

This project launched the pilot testing of a agriculture/science team-teaching model that addressed solutions to agricultural/environmental problems. Objectives included (1) adapting the newly developed REAP-sponsored *Living Soil* videotape and

- Leopold Center-sponsored curriculum;
- (2) using an advisory committee to identify 16 teachers (including representation from four urban schools) to test the model;
 - (3) developing and implementing a pre-testing instrument to assess attitudes and knowledge of agriculture and science teachers and students in terms of solving agricultural/environmental problems;
 - (4) preparing and implementing agriculture/science team-teaching instructions; and
 - (5) providing the Iowa Department of Education with the results of this project for consideration as a prototype for future educational endeavors.

Approach and methods

The follow-up project described here consisted of an educational initiative designed to utilize this curriculum in a way that integrated the disciplines of agriculture and science in Iowa schools. It was also the first effort to measure what effect the curriculum had on high school and middle-school students' perceptions, attitudes, and knowledge of sustainable agriculture. One important component of the evaluation was to compare team-teaching (agriculture and science) to single-discipline teaching. Nine agriculture and seven science teachers provided data for the curriculum evaluation. Student participation included 145 agriculture students and 308 science students.

Intensive production of corn and soybeans, conventional tillage, over-dependence on agricultural chemicals, and a focus on attaining high yields

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Budget
\$16,000 for one year

Willie the earthworm was the principal character in the materials designed for this curriculum.

using external inputs rather than on net profit have had a major negative impact on the soil environment. However, agriculture teachers have traditionally taught these production concepts. In the four years since the Agricultural Education and Studies Department at Iowa State University initiated sustainable agricul-

ture curricula in the high schools, progress has been made in terms of working with teachers, yet there remains a need for attitudinal change and greater sensitivity to how agriculture systems affect the environment.

Iowa's future is dependent on this attitudinal change, and high school agriculture and science teachers can be important agents of this change by helping to shape the attitudes of future farmers and rural/urban citizens. To be effective, however, they must be equipped with innovative educational tools and involve their students in hands-on experiences.

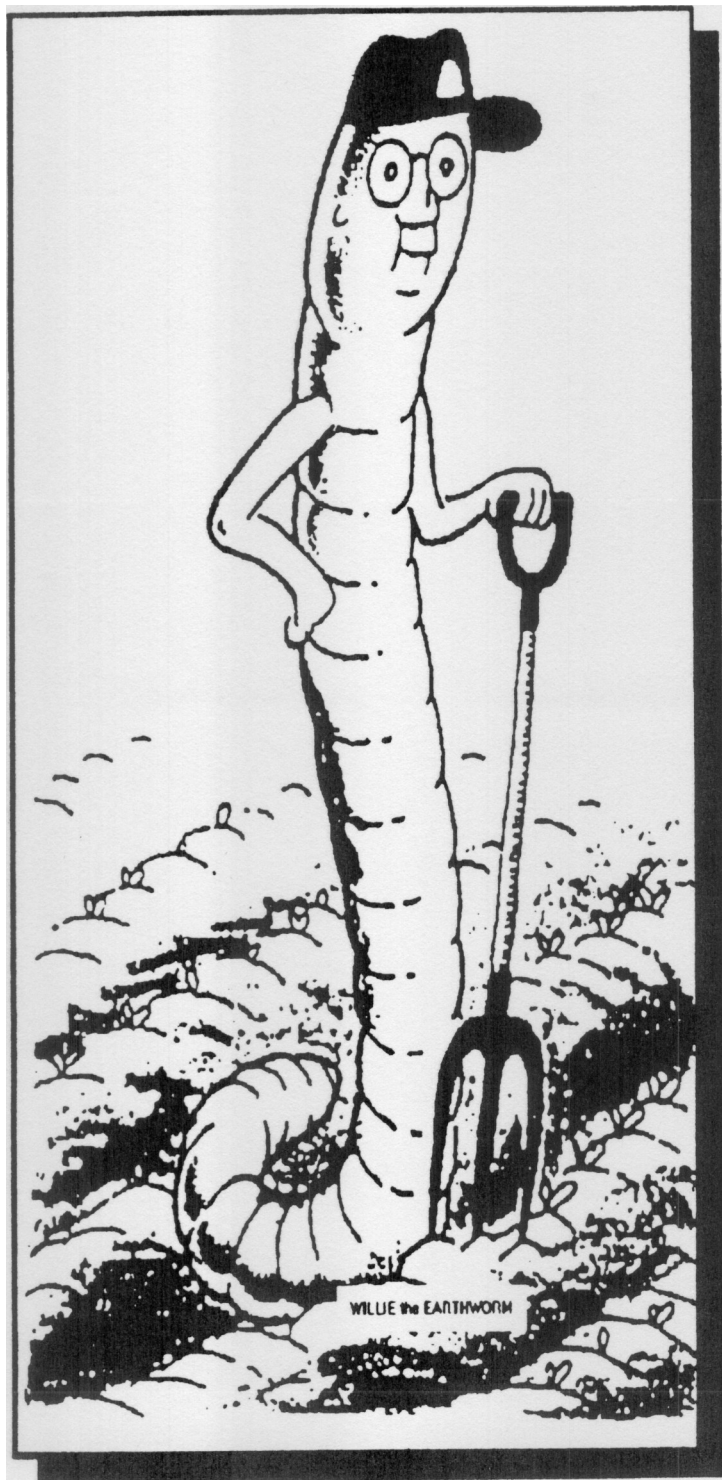
These teachers, who are expert in using laboratory and field exercises to stimulate student interest and develop higher-order thinking skills, agree that the most motivating learning experiences are created with live animals and plants. In the teaching materials developed for this pilot project, the earthworm—nature's master soil builder—holds real potential for motivating student interest in soil biology.

The topic of the "living soil" as a common denominator of global significance was selected as the subject for this project in order to reach agricultural as well as non-agricultural students. The close working relationship between ISU's Department of Agricultural Education and Studies and the National Soil Tilth Laboratory, USDA/ARS, provided a unique opportunity to feature live earthworms in this unique approach to stimulating student interest in soil biology.

Another important component of the project compared team-to single-discipline teaching.

Findings

Teachers and students alike expressed a high degree of interest in the team approach. Teachers were enthusiastic about team teaching, although their efforts were somewhat hampered due to time constraints and scheduling conflicts. Teachers had positive attitudes toward team teaching as an instructional procedure, and they strongly agreed about the types of characteristics team teachers should have. However, a longer team-teaching pe-



riod would need to be studied in order to accurately assess changes in teacher attitudes.

In addition to their increased knowledge, team-taught students showed positive changes in perceptions of and attitudes toward sustainable agriculture. Their scores were not consistently higher or lower than those of agriculture or science students—an encouraging finding that indicates team teaching is a viable option for teaching sustainable agriculture concepts.

Teachers identified time as the biggest factor in making increased team teaching efforts. School schedules generally do not promote planning for team teaching, and some teachers in this project were team teaching at the expense of their preparation periods. These efforts are encouraging, but changes would need to be made in teaching schedules to allow for joint planning and teaching time.

In October 1994, teachers were given an in-service using the Iowa Communications Network. The ICN in-service provided an opportunity for teachers to learn about the project, voice questions and concerns, and interact with each other. Ten ICN sites were used, and 14 of the 19 participating teachers provided evaluations. One teacher remarked that the ICN was an excellent way to interact. Other comments typical of the teachers' responses were "I appreciated meeting the people without having to travel." "This method is great!" "Next to a face-to-face meeting, the use of the ICN allowed us to interact and ask questions and get immediate answers."

Implications

The results of the study reinforce the observation that team teaching can be effective if the subject matter is appropriate and teaching materials are easy to use. This approach provides an avenue for agriculture concepts to reach traditionally "non-agriculture" teachers and students.

In the future, the ICN will be considered as a means to reach the maximum number of teachers at the least cost and time involvement.

Teachers identified time as the greatest factor in increasing their team teaching efforts. School schedules that do not permit planning for team teaching will need to be reconsidered if team teaching is to be promoted.

This pilot project has led to Leopold Center funding of a third project designed to build on the linkage between agriculture and science. This next phase will focus on enhancing interaction between Iowa's rural and urban citizens to foster a better understanding of how to achieve profitable, environmentally sound family farms. The rationale is that urbanites who are informed about many aspects of farms and farmers will be less likely to form negative judgments about farmers' commitment to the environment.

This new project will adapt materials to the science classroom and develop guides for student and team teaching. The pilot-study teachers have been invited to continue their participation in the project. An advisory committee will again provide direction for the project.

A field-testing packet was developed for testing by 30 teachers. Designed for cross-disciplinary teaching, the new educational materials will contain laboratory and field activities from the *Living Soil* curriculum modified to incorporate learning-cycle principles (exploration, concept development, and application).

The project investigator introduced this project to a broad general audience at the 1995 Annual Meeting of the Soil and Water Conservation Society, where 17 participants agreed to arrange for teacher field-testing of the educational packet.

Education and outreach: As a result of this project, one participating teacher brought a group of talented and gifted students from Council Bluffs to the ISU campus to see the earthworm laboratory in the National Science Tilth Laboratory. More than 100 high school agriculture teachers, 15 high school and middle school science teachers, 70 elementary teachers, and 1,200 agriculture and science middle school and high school students were ac-

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quainted with the project as a result of other such contacts. Displays about this project were shown at various conferences; at the 1995 Agricultural Education Conference of Central States in St. Louis, Missouri, the project display received a top rating and was chosen to be displayed at the national conference.

Organizations who have assisted this and other sustainable-agriculture efforts in ISU's Agricultural Education and Studies Department

include the Iowa Association of Soil and Water Conservation District Commissioners, Iowa FFA, Natural Resources Conservation Service, Iowa Vocational Agriculture Teachers Association (IVATA), Iowa Department of Natural Resources, ISU Extension, and Practical Farmers of Iowa. Leadership for the teacher in-service was coordinated through the IVATA, the Iowa Academy of Teachers, and the Iowa Department of Education.